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Johnsville, Warminster, Pennsylvania

SYSTEMS ANALYSIS AND ENGINEERING DEPARTMENT

TECHNICAL MEMORANDUM 68-000-7 19 AUGUST 1968

LEAST SQUARES CURVE FITTING ROUTINE USER'S GUIDE

DEPARTMENT OF THE NAVY
NAVAL AIR DEVELOPMENT CENTER
JOHNSVILLE
WARMINSTER, PA. 18974

Systems Analysis and Engineering Department

TECHNICAL MEMORANDUM 68-000-7

19 August 1968

Least Squares Curve Fitting Routine
User's Guide

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INTRODUCTION

This technical memorandum provides a complete set of input instructions for the LEAST (Least Squares Curve Fitting Routine) developed at the Naval Air Development Center, Johnsville, Warminster, Pennsylvania. The memorandum begins with a brief description of the program's capability, followed by general information concerning input specification. The necessary input variables are then explained in full, and format specifications are provided. Inputs for a sample problem are listed in appendix A, and the sample output is listed in appendix B.

TABLE OF CONTENTS

DISCUSSION

General Program Description

The Least Squares Curve Fitting Routine is designed primarily to derive a numerical relationship between a designated independent variable and a dependent variable by the method of least squares regression. The regression equation is an equation of the form:

$$Y = b_1 + b_2X + b_3X^2 + \ldots + b_MX^{KM}$$

where

Y = the independent variable

X = the dependent variable

M = the number of data points

B_i = constants to be determined (i=1,M)

KM = the maximum degree of the equation (KM=M-1)

The program calculates the errors involved in fitting raw data to a mathematical curve including the variance for each data point, the average variance for each coefficient, and the adjusted standard error of estimate. For a complete explanation of regression equations, standard error of estimate, and variance, see reference (a).

The program will also generate the coefficients of Legendre polynomials or orthogonal polynomials if so desired. A Legendre polynomial is a solution of Legendre's equation, which is the linear second order differential equation:

$$(1-X^2)\frac{d^2y}{dx^2} - 2X\frac{dy}{dx} + n(n+1)y = 0$$

where

$\frac{d^2y}{dx^2}$ = the second derivative of X with respect to Y

$\frac{dy}{dx}$ = the first derivative of X with respect to Y

n = a given constant

An orthogonal polynomial is one whose coefficients are mutually orthogonal with the coefficients of another polynomial; that is, two polynomials whose inner product is equal to 0. In the program, the orthogonal coefficients are orthogonal to the regression coefficients.

The user may select the maximum degree of the regression equation, although this will be limited to one less than the number of data points; or if Legendre polynomials are generated, less than or equal to 10; or if orthogonal coefficients are calculated, less than or equal to 20.

A weighting system can be used in order to put more emphasis on points of greater significance in developing the regression equation. If the weighting system is not used, the program will assign all points a weighting factor of 1.

Preparation of the Data Deck

General Information

All input variables are specified on 80-column Hollerith cards. The inputs are either data or control variables. In the following instructions, each input card will be considered in sequence. Each description will include the variable name as it appears in the program, the columns into which the variable is punched, the variable type in parenthesis (data or control-integer or decimal), and the definition of the variable with any needed instructions. In any field, a decimal variable must include the decimal point, and an integer variable must be right-justified and must not include a decimal point.

Data Arrangement

Card 1

M cols. 1-5 (control-integer)
KM cols. 6-10 (control-integer)
ISW cols. 11-15 (control-integer)
LP cols. 16-20 (control-integer)
IW cols. 21-25 (control-integer)

M is the number of raw data points to be read.

KM is the maximum degree of the regression equation.

ISW controls the production of orthogonal polynomials. If ISW is equal to 1, the coefficients of an orthogonal polynomial will be generated; if ISW is equal to 0, they will not be generated. The calculation of orthogonal polynomials limits the degree of the regression equation to less than or equal to 20.

LP controls the production of Legendre polynomials. If LP is equal to 1, the coefficients of a Legendre polynomial will be produced; if LP is equal to 0, they will not be calculated. The calculation of Legendre polynomials limits the degree of the regression equation to less than or equal to 10.

IW determines if a weighting system is to be used to place greater emphasis in the regression equation on more significant data points. If IW equals 0, the system is not used and the program makes all weights equal to 1. If IW equals 1, weighting factors must be read in with each point.

Card 2

a. If IW is equal to 0, read in the M data points, each point occupying 2 F10 fields with four points per card. Place the dependent variable (X_i) in the first field and the independent variable ($F2_i$) in the second field. Use as many cards as necessary until all M points have been entered on cards. For example:

X_1 cols. 1-10 (data-decimal)

$F2_1$ cols. 11-20 (data-decimal)

X_2 cols. 21-30 (data-decimal)

$F2_2$ cols. 31-40 (data decimal)

etc.

b. If IW is equal to 1, read in the M data points with their weight factors, each point and its weight occupying 3 F10 fields with two points per card. Place the dependent variable (X_i) in the first field, the independent variable ($F2_i$) in the second field, and the weighting factor (W_i) in the third field. Use as many cards as necessary until all M points have been entered on cards. For example:

X_1 cols. 1-10 (data-decimal)

$F2_1$ cols. 11-20 (data-decimal

W_1 cols. 21-30 (data-decimal)

X_2 cols. 31-40 (data-decimal)

etc.

Multiple runs are possible by placing new values of the variables on card 1 in back of the previous run and proceeding as before. A blank card will terminate the program.

REFERENCE

(a) U. S. Air Force Project RAND Unclassified memo "Use of Statistical Regression Analysis in Deriving Estimating Relationships," Concepts and Procedures of Cost Analysis, by G. H. Fisher, June 1963

APPENDIX A

SAMPLE PROBLEM INPUTS

General Description

A user wants to determine two relationships; between an independent variable A and a dependent variable B, and also between another independent variable C and a dependent variable D; using the method of least squares regression. In the first case, he knows the coordinates of 9 points and he wishes the maximum degree of the regression equation to be equal to 8. He does not want to use the weighting system, and he does not want Legendre or orthogonal polynomial coefficients. In the second case, he knows the coordinates of 12 points, he wants the maximum degree of the regression to be 11, and he wants the coefficients of both Legendre and orthogonal polynomials. Again he does not want to use a weighting system.

In the first run, the user inputs the values of A into the F2 fields of the program since F2 is the independent variable. He also inputs the values of B into the X fields of the program. In the second case, he inputs the values of C into the F2 fields and D into the X fields; the points for each case are listed below.

First case (B,A) points

(0,0); (90.0,7.30); (20.0,3.95); (30.0,4.95); (40.0,5.60);
(50.0,6.10); (60.0,6.45); (70.0,6.80); (80.0,7.05)

Second case (D,C) points

(1.65,1.50); (2.42,1.76); (4.10,1.65); (5.70,2.17);
(7.65,2.43); (11.3,2.48); (15.7,3.0); (21.6,3.05);
(24.0,3.58); (34.2,3.12); (50.0,4.07); (76.1, 5.21)

Problem Inputs

Card No.	Variable	Value	Card Columns
1	M	9	5
1	KM	8	10
2	X_1	0.0	1-3
2	$F2_1$	0.0	11-13
2	X_2	90.0	21-24
2	$F2_2$	7.30	31-34
2	X_3	20.0	41-44
2	$F2_3$	3.95	51-54

Card No.	Variable	Value	Card Columns
2	X_4	30.0	61-64
2	$F2_4$	4.95	71-74
3	X_5	40.0	1-4
3	$F2_5$	5.60	11-14
3	X_6	50.0	21-24
3	$F2_6$	6.10	31-34
3	X_7	60.0	41-44
3	$F2_7$	6.45	51-54
3	X_8	70.0	61-64
3	$F2_8$	6.80	71-74
4	X_9	80.0	1-4
4	$F2_9$	7.05	11-14
5	M	12	4-5
5	KM	11	9-10
5	ISW	1	15
5	LP	1	20
6	X_1	1.65	1-4
6	$F2_1$	1.50	11-14
6	X_2	2.42	21-24
6	$F2_2$	1.76	31-34
6	X_3	4.10	41-44
6	$F2_3$	1.65	51-54
6	X_4	5.70	61-64
6	$F2_4$	2.17	71-74
7	X_5	7.65	1-4
7	$F2_5$	2.43	11-14
7	X_6	11.3	21-24
7	$F2_6$	2.48	31-34
7	X_7	15.7	41-44
7	$F2_7$	3.0	51-53
7	X_8	21.6	61-64
7	$F2_8$	3.05	71-74
8	X_9	24.0	1-4
8	$F2_9$	3.58	11-14
8	X_{10}	34.2	21-24
8	$F2_{10}$	3.12	31-34
8	X_{11}	50.0	41-44
8	$F2_{11}$	4.07	51-54
8	X_{12}	76.1	61-64
8	$F2_{12}$	5.21	71-74
9	Blank Card		1-80
10	EOF control	7 7 8 8	1-2

APPENDIX B

SAMPLE PROBLEM OUTPUT

The following pages list the complete output of the Least Squares Regression Routine for the problem described in appendix A. Note that SIGMA is the adjusted standard error of estimate. In the chart at the bottom of each output page, X(I) is the dependent variable, F(I) is the given value of the independent variable, Y(I) is the value of the independent variable calculated using the regression coefficients, DELY(I) is the calculated value of the independent variable minus the given value, and W(I) is the weighting factor. Note also, in the second run, that the regression equation was limited to a maximum degree of 10, due to the calculation of the Legendre coefficients.

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)= 1.9203225807E 00 ERRB= 7.1005650137E-01
B(2)= 7.0266129030E-02 ERRB= 1.2353809546E-02

SIGMA = 1.0553579233E 00

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)= 5.3555555554E 00 ERRT= 3.7337339881E-01
T(2)= 7.0266129030E-02 ERRT= 1.2353809546E-02

I	x(I)	F(I)	Y(I)	DELY(I)	W(I)
1	0	0	1.9203226E 00	1.9203226E 00	1.0000000E 00
2	9.0000000E 01	7.3000000E 00	8.2442742E 00	9.4427419E-01	1.0000000E 00
3	2.0000000E 01	3.9500000E 00	3.3256452E 00	-6.2435484E-01	1.0000000E 00
4	3.0000000E 01	4.9500000E 00	4.0283065E 00	-9.2169355E-01	1.0000000E 00
5	4.0000000E 01	5.6000000E 00	4.7309677E 00	-8.6903226E-01	1.0000000E 00
6	5.0000000E 01	6.1000000E 00	5.4336290E 00	-6.6637097E-01	1.0000000E 00
7	6.0000000E 01	6.4500000E 00	6.1362903E 00	-3.1370968E-01	1.0000000E 00
8	7.0000000E 01	6.8000000E 00	6.8389516E 00	3.8951613E-02	1.0000000E 00
9	8.0000000E 01	7.0500000E 00	7.5416129E 00	4.9161290E-01	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)= 3.9069518755E-01 ERRB= 3.5713433655E-01
B(2)= 1.7442647057E-01 ERRB= 1.6551144014E-02
B(3)= -1.1290106950E-03 ERRB= 1.7211761370E-04

SIGMA = 3.8744040999E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)= 5.3555555554E 00 ERRT= 1.4520815759E-01
T(2)= 7.0266129030E-02 ERRT= 4.6679943916E-03
T(3)= -1.1290106950E-03 ERRT= 1.7211761370E-04

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	0	0	3.9069519E-01	3.9069519E-01	1.0000000E 00
2	9.0000000E 01	7.3000000E 00	6.9440909E 00	-3.5590909E-01	1.0000000E 00
3	2.0000000E 01	3.9500000E 00	3.4276203E 00	-5.2237968E-01	1.0000000E 00
4	3.0000000E 01	4.9500000E 00	4.6073797E 00	-3.4262032E-01	1.0000000E 00
5	4.0000000E 01	5.6000000E 00	5.5813369E 00	-3.8663102E-02	1.0000000E 00
6	5.0000000E 01	6.1000000E 00	6.2894920E 00	1.8949198E-01	1.0000000E 00
7	6.0000000E 01	6.4500000E 00	6.7918449E 00	3.4184492E-01	1.0000000E 00
8	7.0000000E 01	6.8000000E 00	7.0683957E 00	2.6839572E-01	1.0000000E 00
9	8.0000000E 01	7.0500000E 00	7.1191444E 00	6.9144385E-02	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)= 4.1163976231E-02 ERRB= 1.0201677021E-01
B(2)= 2.4990064199E-01 ERRB= 9.4430243867E-03
B(3)= -3.3878858702E-03 ERRB= 2.5468561350E-04
B(4)= 1.6842490342E-05 ERRB= 1.8685602041E-06

SIGMA = 1.0219102125E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)= 5.3555555554E 00 ERRT= 3.8696227584E-02
T(2)= 7.0266129030E-02 ERRT= 1.2312270527E-03
T(3)= -1.1290106950E-03 ERRT= 4.5397625713E-05
T(4)= 1.6842490342E-05 ERRT= 1.8685602041E-06

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	0	0	4.1163976E-02	4.1163976E-02	1.0000000E 00
2	9.0000000E 01	7.3000000E 00	7.3685217E 00	6.8521665E-02	1.0000000E 00
3	2.0000000E 01	3.9500000E 00	3.8187624E 00	-1.3123761E-01	1.0000000E 00
4	3.0000000E 01	4.9500000E 00	4.9438332E 00	-6.1668081E-03	1.0000000E 00
5	4.0000000E 01	5.6000000E 00	5.6944916E 00	9.4491645E-02	1.0000000E 00
6	5.0000000E 01	6.1000000E 00	6.1717927E 00	7.1792693E-02	1.0000000E 00
7	6.0000000E 01	6.4500000E 00	6.4767913E 00	2.6791277E-02	1.0000000E 00
8	7.0000000E 01	6.8000000E 00	6.7105423E 00	-8.9457662E-02	1.0000000E 00
9	8.0000000E 01	7.0500000E 00	6.9741008E 00	-7.5899179E-02	1.0000000E 00

COEFFICIENTS OF $Y=B_1+B_2*X+ETC$ AND ERRORS

B(1)=	1.9500322160E-03	ERRB=	2.1546535805E-02
B(2)=	2.8629641913E-01	ERRB=	3.9711140214E-03
B(3)=	-5.4617765773E-03	ERRB=	2.0361623204E-04
B(4)=	5.3427146911E-05	ERRB=	3.4896761575E-06
B(5)=	-2.0095268239E-07	ERRB=	1.9048596293E-08

SIGMA = 2.1281354199E-02

COEFFICIENTS OF $Y=T1*P1+T2*P2+ETC$ AND ERRORS

T(1)=	5.3555555554E 00	ERRT=	8.0014303303E-03
T(2)=	7.0266129030E-02	ERRT=	2.5640392557E-04
T(3)=	-1.1290106950E-03	ERRT=	9.4540884392E-06
T(4)=	1.6842490342E-05	ERRT=	3.8912901603E-07
T(5)=	-2.0095268238E-07	ERRT=	1.9048596293E-08

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	0	0	1.9500322E-03	1.9500322E-03	1.0000000E 00
2	9.0000000E 01	7.3000000E 00	7.2921221E 00	-7.8779150E-03	1.0000000E 00
3	2.0000000E 01	3.9500000E 00	3.9384325E 00	-1.1567470E-02	1.0000000E 00
4	3.0000000E 01	4.9500000E 00	4.9550050E 00	5.0049804E-03	1.0000000E 00
5	4.0000000E 01	5.6000000E 00	5.6198628E 00	1.9862809E-02	1.0000000E 00
6	5.0000000E 01	6.1000000E 00	6.0847686E 00	-1.5231355E-02	1.0000000E 00
7	6.0000000E 01	6.4500000E 00	6.4532565E 00	3.2564709E-03	1.0000000E 00
8	7.0000000E 01	6.8000000E 00	6.7806316E 00	-1.9368371E-02	1.0000000E 00
9	8.0000000E 01	7.0500000E 00	7.0739708E 00	2.3970816E-02	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

```
B( 1)= -1.7130529153E-04        ERRB=  1.6941036663E-02
B( 2)=  2.9808625091E-01        ERRB=  7.0283523605E-03
B( 3)= -6.4740353194E-03        ERRB=  5.6403214526E-04
B( 4)=  8.3161000949E-05        ERRB=  1.6123723626E-05
B( 5)= -5.6130809169E-07        ERRB=  1.9315170385E-07
B( 6)=  1.5434090173E-09        ERRB=  8.2479362553E-10

SIGMA =    1.6692362068E-02
```

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

```
T( 1)=  5.3555555554E 00        ERRT=  6.2833221093E-03
T( 2)=  7.0266129030E-02        ERRT=  2.0111441787E-04
T( 3)= -1.1290106950E-03        ERRT=  7.4154617125E-06
T( 4)=  1.6842490342E-05        ERRT=  3.0521941254E-07
T( 5)= -2.0095268238E-07        ERRT=  1.4941063583E-08
T( 6)=  1.5434090172E-09        ERRT=  8.2479362553E-10
```

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	0	0	-1.7130529E-04	-1.7130529E-04	1.0000000E 00
2	9.0000000E 01	7.3000000E 00	7.2985269E 00	-1.4731080E-03	1.0000000E 00
3	2.0000000E 01	3.9500000E 00	3.9523572E 00	2.3572071E-03	1.0000000E 00
4	3.0000000E 01	4.9500000E 00	4.9439767E 00	-6.0232548E-03	1.0000000E 00
5	4.0000000E 01	5.6000000E 00	5.6082226E 00	8.2226498E-03	1.0000000E 00
6	5.0000000E 01	6.1000000E 00	6.0883178E 00	-1.1682195E-02	1.0000000E 00
7	6.0000000E 01	6.4500000E 00	6.4668548E 00	1.6854788E-02	1.0000000E 00
8	7.0000000E 01	6.8000000E 00	6.7843168E 00	-1.5683227E-02	1.0000000E 00
9	8.0000000E 01	7.0500000E 00	7.0575984E 00	7.5984410E-03	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

```
B( 1)=  2.5523144853E-05        ERRB=  1.9811285944E-02
B( 2)=  2.8914255984E-01        ERRB=  2.1858920000E-02
B( 3)= -5.4626867643E-03        ERRB=  2.3835426038E-03
B( 4)=  4.1034409433E-05        ERRB=  9.7253155084E-05
B( 5)=  2.5793398204E-07        ERRB=  1.8691207536E-06
B( 6)= -5.9814192008E-09        ERRB=  1.7069587482E-08
B( 7)=  2.6356356475E-11        ERRB=  5.9692224333E-11

SIGMA =    1.9514866668E-02
```

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

```
T( 1)=  5.3555955554E 00        ERRT=  7.3476008762E-03
T( 2)=  7.0266129030E-02        ERRT=  2.3512077163E-04
T( 3)= -1.1290106950E-03        ERRT=  8.6693390668E-06
T( 4)=  1.6842490342E-05        ERRT=  3.5682883679E-07
T( 5)= -2.0095268238E-07        ERRT=  1.7467441846E-08
T( 6)=  1.5434090172E-09        ERRT=  9.6425763858E-10
T( 7)=  2.6356356475E-11        ERRT=  5.9692224335E-11
```

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	0	0	2.5523145E-05	2.5523145E-05	1.0000000E 00
2	9.0000000E 01	7.3000000E 00	7.2993924E 00	-6.0764141E-04	1.0000000E 00
3	2.0000000E 01	3.9500000E 00	3.9498930E 00	-1.0700786E-04	1.0000000E 00
4	3.0000000E 01	4.9500000E 00	4.9486051E 00	-1.3948920E-03	1.0000000E 00
5	4.0000000E 01	5.6000000E 00	5.6074006E 00	7.4006015E-03	1.0000000E 00
6	5.0000000E 01	6.1000000E 00	6.0844497E 00	-1.5550259E-02	1.0000000E 00
7	6.0000000E 01	6.4500000E 00	6.4676942E 00	1.7694204E-02	1.0000000E 00
8	7.0000000E 01	6.8000000E 00	6.7884646E 00	-1.1535357E-02	1.0000000E 00
9	8.0000000E 01	7.0500000E 00	7.0540748E 00	4.0748271E-03	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

```
B( 1)= -3.2210708244E-05      ERRB=  2.6435656557E-02
B( 2)=  3.2101544534E-01      ERRB=  9.5328282088E-02
B( 3)= -9.8695756900E-03      ERRB=  1.2945196759E-02
B( 4)=  2.7843080938E-04      ERRB=  6.8831920471E-04
B( 5)= -6.1756196830E-06      ERRB=  1.8488261757E-05
B( 6)=  8.7245292733E-08      ERRB=  2.6643443772E-07
B( 7)= -6.6304989278E-10      ERRB=  1.9646703681E-09
B( 8)=  2.0438239075E-12      ERRB=  5.8197023505E-12

SIGMA =    2.6039099530E-02
```

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

```
T( 1)=  5.3555555554E 00      ERRT=  9.8054811277E-03
T( 2)=  7.0266129030E-02      ERRT=  3.1372662075E-04
T( 3)= -1.1290106950E-03      ERRT=  1.1567682561E-05
T( 4)=  1.6842490342E-05      ERRT=  4.7612426744E-07
T( 5)= -2.0095268238E-07      ERRT=  2.3307177266E-08
T( 6)=  1.5434090172E-09      ERRT=  1.2866293709E-09
T( 7)=  2.6356356475E-11      ERRT=  7.9648598022E-11
T( 8)=  2.0438239075E-12      ERRT=  5.8197023504E-12
```

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	0	0	-3.2210708E-05	-3.2210708E-05	1.0000000E 00
2	9.0000000E 01	7.3000000E 00	7.2997423E 00	-2.5768136E-04	1.0000000E 00
3	2.0000000E 01	3.9500000E 00	3.9511596E 00	1.1595839E-03	1.0000000E 00
4	3.0000000E 01	4.9500000E 00	4.9445886E 00	-5.4113910E-03	1.0000000E 00
5	4.0000000E 01	5.6000000E 00	5.6121756E 00	1.2175634E-02	1.0000000E 00
6	5.0000000E 01	6.1000000E 00	6.0837658E 00	-1.6234182E-02	1.0000000E 00
7	6.0000000E 01	6.4500000E 00	6.4635285E 00	1.3528485E-02	1.0000000E 00
8	7.0000000E 01	6.8000000E 00	6.7930425E 00	-6.9575044E-03	1.0000000E 00
9	8.0000000E 01	7.0500000E 00	7.0520293E 00	2.0292818E-03	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

```
B( 1)=  9.0103036142E-11        ERRB=                   0
B( 2)= -1.0787107150E-01        ERRB=                   0
B( 3)=  5.9402734296E-02        ERRB=                   0
B( 4)= -4.2676122641E-03        ERRB=                   0
B( 5)=  1.5183517850E-04        ERRB=                   0
B( 6)= -3.0699448079E-06        ERRB=                   0
B( 7)=  3.5761962528E-08        ERRB=                   0
B( 8)= -2.2348987467E-10        ERRB=                   0
B( 9)=  5.8008160880E-13        ERRB=                   0

SIGMA =                  0
```

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

```
T( 1)=  5.3555555554E 00        ERRT=                   0
T( 2)=  7.0266129030E-02        ERRT=                   0
T( 3)= -1.1290106950E-03        ERRT=                   0
T( 4)=  1.6842490342E-05        ERRT=                   0
T( 5)= -2.0095268238E-07        ERRT=                   0
T( 6)=  1.5434090172E-09        ERRT=                   0
T( 7)=  2.6356356475E-11        ERRT=                   0
T( 8)=  2.0438239075E-12        ERRT=                   0
T( 9)=  5.8008160879E-13        ERRT=                   0
```

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	0	0	9.0103036E-11	9.0103036E-11	1.0000000E 00
2	9.0000000E 01	7.3000000E 00	7.3000002E 00	1.9965228E-07	1.0000000E 00
3	2.0000000E 01	3.9500000E 00	3.9500000E 00	1.2223609E-09	1.0000000E 00
4	3.0000000E 01	4.9500000E 00	4.9500000E 00	8.9639798E-09	1.0000000E 00
5	4.0000000E 01	5.6000000E 00	5.6000000E 00	1.0943040E-08	1.0000000E 00
6	5.0000000E 01	6.1000000E 00	6.1000000E 00	2.2817403E-08	1.0000000E 00
7	6.0000000E 01	6.4500000E 00	6.4500001E 00	7.1013346E-08	1.0000000E 00
8	7.0000000E 01	6.8000000E 00	6.8000002E 00	2.1408778E-07	1.0000000E 00
9	8.0000000E 01	7.0500000E 00	7.0500003E 00	3.1932723E-07	1.0000000E 00

>>>> END OF LEAST SQUARES FIT <<<<

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)= 1.8627814261E 00 ERRB= 1.7714080080E-01
B(2)= 4.5855761684E-02 ERRB= 4.5802585791E-03

SIGMA = 3.4275098548E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)= 2.8350000000E 00 ERRT= 1.4815087906E-01
T(2)= 4.5855761683E-02 ERRT= 4.5802585791E-03

LEGENDRE POLYNOMIALS
COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

C(1)= 1.8627814261E 00 ERRC= 1.7714080080E-01
C(2)= 4.5855761684E-02 ERRC= 4.5802585791E-03

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500000E 00	1.5000000E 00	1.9384434E 00	4.3844343E-01	1.0000000E 00
2	2.4200000E 00	1.7600000E 00	1.9737524E 00	2.1375237E-01	1.0000000E 00
3	4.1000000E 00	1.6500000E 00	2.0507900E 00	4.0079005E-01	1.0000000E 00
4	5.7000000E 00	2.1700000E 00	2.1241593E 00	-4.5840732E-02	1.0000000E 00
5	7.6500000E 00	2.4300000E 00	2.2135780E 00	-2.1642200E-01	1.0000000E 00
6	1.1300000E 01	2.4800000E 00	2.3809515E 00	-9.9048467E-02	1.0000000E 00
7	1.5700000E 01	3.0000000E 00	2.5827169E 00	-4.1728312E-01	1.0000000E 00
8	2.1600000E 01	3.0500000E 00	2.8532659E 00	-1.9673412E-01	1.0000000E 00
9	2.4000000E 01	3.5800000E 00	2.9633197E 00	-6.1668029E-01	1.0000000E 00
10	3.4200000E 01	3.1200000E 00	3.4310485E 00	3.1104848E-01	1.0000000E 00
11	5.0000000E 01	4.0700000E 00	4.1555695E 00	8.5569510E-02	1.0000000E 00
12	7.6100000E 01	5.2100000E 00	5.3524049E 00	1.4240489E-01	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)= 1.6799612796E 00 ERRB= 2.0525880752E-01
B(2)= 6.7473069375E-02 ERRB= 1.4468745794E-02
B(3)= -3.0071277524E-04 ERRB= 1.9225873030E-04

SIGMA = 3.2036407521E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)= 2.8350000000E 00 ERRT= 1.4223420763E-01
T(2)= 4.5855761683E-02 ERRT= 4.2810972574E-03
T(3)= -3.0071277524E-04 ERRT= 1.9225873029E-04

LEGENDRE POLYNOMIALS
COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

C(1)= 1.6798610420E 00 ERRC= 2.0529530826E-01
C(2)= 6.7473069375E-02 ERRC= 1.4468745794E-02
C(3)= -2.0047518349E-04 ERRC= 1.2817248687E-04

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500000E 00	1.5000000E 00	1.7904732E 00	2.9047315E-01	1.0000000E 00
2	2.4200000E 00	1.7600000E 00	1.8414850E 00	8.1485013E-02	1.0000000E 00
3	4.1000000E 00	1.6500000E 00	1.9515459E 00	3.0154588E-01	1.0000000E 00
4	5.7000000E 00	2.1700000E 00	2.0547876E 00	-1.1521238E-01	1.0000000E 00
5	7.6500000E 00	2.4300000E 00	2.1785318E 00	-2.5146820E-01	1.0000000E 00
6	1.1300000E 01	2.4800000E 00	2.4040089E 00	-7.5991051E-02	1.0000000E 00
7	1.5700000E 01	3.0000000E 00	2.6651658E 00	-3.3483422E-01	1.0000000E 00
8	2.1600000E 01	3.0500000E 00	2.9970790E 00	-5.2920974E-02	1.0000000E 00
9	2.4000000E 01	3.5800000E 00	3.1261044E 00	-4.5389561E-01	1.0000000E 00
10	3.4200000E 01	3.1200000E 00	3.6358146E 00	5.1581456E-01	1.0000000E 00
11	5.0000000E 01	4.0700000E 00	4.3018328E 00	2.3183281E-01	1.0000000E 00
12	7.6100000E 01	5.2100000E 00	5.0731710E 00	-1.3682897E-01	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)= 1.3784n75906E 00 ERRB= 1.9362918132E-01
B(2)= 1.3411600135E-01 ERRB= 2.7368484585E-02
B(3)= -2.8358169514E-03 ERRB= 9.6203109114E-04
B(4)= 2.2865279499E-05 ERRB= 8.5731978274E-06

SIGMA = 2.4722153791E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)= 2.8350n00000E 00 ERRT= 1.0801153841E-01
T(2)= 4.5855761683E-02 ERRT= 3.3036770657E-03
T(3)= -3.0071277524E-04 ERRT= 1.4836401038E-04
T(4)= 2.2865279499E-05 ERRT= 8.5731978274E-06

LEGENDRE POLYNOMIALS
COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

C(1)= 1.3774623183E 00 ERRC= 1.9383738501E-01
C(2)= 1.3412972051E-01 ERRC= 2.7373181051E-02
C(3)= -1.8905446342E-03 ERRC= 6.4135406074E-04
C(4)= 9.1461117992E-06 ERRC= 3.4292791311E-06

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500n00E 00	1.5000000E 00	1.5920812E 00	9.2081195E-02	1.0000000E 00
2	2.4200n00E 00	1.7600000E 00	1.6866847E 00	-7.3315307E-02	1.0000000E 00
3	4.1000n00E 00	1.6500000E 00	1.8821890E 00	2.3218901E-01	1.0000000E 00
4	5.7000n00E 00	2.1700000E 00	2.0549676E 00	-1.1503240E-01	1.0000000E 00
5	7.6500n00E 00	2.4300000E 00	2.2486726E 00	-1.8132738E-01	1.0000000E 00
6	1.1300n00E 01	2.4800000E 00	2.5648052E 00	8.4805183E-02	1.0000000E 00
7	1.5700n00E 01	3.0000000E 00	2.8735145E 00	-1.2648552E-01	1.0000000E 00
8	2.1600n00E 01	3.0500000E 00	3.1826638E 00	1.3266380E-01	1.0000000E 00
9	2.4000n00E 01	3.5800000E 00	3.2798507E 00	-3.0014932E-01	1.0000000E 00
10	3.4200n00E 01	3.1200000E 00	3.5629397E 00	4.4293967E-01	1.0000000E 00
11	5.0000n00E 01	4.0700000E 00	3.8528252E 00	-2.1717478E-01	1.0000000E 00
12	7.6100n00E 01	5.2100000E 00	5.2388059E 00	2.8805852E-02	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

```
B( 1)=  1.1339751109E 00        ERRB=  2.3809462495E-01
B( 2)=  2.1729044783E-01        ERRB=  5.9209918028E-02
B( 3)= -8.6811378112E-03        ERRB=  3.8671065463E-03
B( 4)=  1.5539029572E-04        ERRB=  8.5702999867E-05
B( 5)= -9.1429049615E-07        ERRB=  5.8874528194E-07
```

SIGMA = 2.2792843535E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

```
T( 1)=  2.8350000000E 00        ERRT=  9.9811849073E-02
T( 2)=  4.5855761683E-02        ERRT=  3.0458589929E-03
T( 3)= -3.0071277524E-04        ERRT=  1.3678572278E-04
T( 4)=  2.2865279499E-05        ERRT=  7.9041477670E-06
T( 5)= -9.1429049615E-07        ERRT=  5.8874528193E-07
```

LEGENDRE POLYNOMIALS

COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

```
C( 1)=  1.1310812155E 00        ERRC=  2.3906945133E-01
C( 2)=  2.1739168201E-01        ERRC=  5.9258086423E-02
C( 3)= -5.7879476591E-03        ERRC=  2.5783984893E-03
C( 4)=  6.2156118288E-05        ERRC=  3.4281199947E-05
C( 5)= -2.0898068484E-07        ERRC=  1.3457035015E-07
```

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500000E 00	1.5000000E 00	1.4695744E 00	-3.0425592E-02	1.0000000E 00
2	2.4200000E 00	1.7600000E 00	1.6111680E 00	-1.4883195E-01	1.0000000E 00
3	4.1000000E 00	1.6500000E 00	1.8894201E 00	2.3942012E-01	1.0000000E 00
4	5.7000000E 00	2.1700000E 00	2.1183382E 00	-5.1661834E-02	1.0000000E 00
5	7.6500000E 00	2.4300000E 00	2.3547028E 00	-7.5297200E-02	1.0000000E 00
6	1.1300000E 01	2.4800000E 00	2.6902580E 00	2.1025801E-01	1.0000000E 00
7	1.5700000E 01	3.0000000E 00	2.9515411E 00	-4.8458940E-02	1.0000000E 00
8	2.1600000E 01	3.0500000E 00	3.1443049E 00	9.4304948E-02	1.0000000E 00
9	2.4000000E 01	3.5800000E 00	3.1935783E 00	-3.8642172E-01	1.0000000E 00
10	3.4200000E 01	3.1200000E 00	3.3768479E 00	2.5684794E-01	1.0000000E 00
11	5.0000000E 01	4.0700000E 00	4.0055243E 00	-6.4475661E-02	1.0000000E 00
12	7.6100000E 01	5.2100000E 00	5.2147419E 00	4.7418743E-03	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)= 1.4198589824E 00 ERRB= 2.9803034300E-01
B(2)= 8.1399713205E-02 ERRB= 1.0951088142E-01
B(3)= 7.1143780074E-03 ERRB= 1.1570711270E-02
B(4)= -5.2532442886E-04 ERRB= 4.8053380644E-04
B(5)= 1.0935882018E-05 ERRB= 8.2672526834E-06
B(6)= -7.0078297756E-08 ERRB= 4.8782267892E-08

SIGMA = 2.1936394784E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)= 2.8350000000E 00 ERRT= 9.3034564974E-02
T(2)= 4.5855761683E-02 ERRT= 2.8378672424E-03
T(3)= -3.0071277524E-04 ERRT= 1.2744507306E-04
T(4)= 2.2865279499E-05 ERRT= 7.3643993628E-06
T(5)= -9.1429049615E-07 ERRT= 5.4854179184E-07
T(6)= -7.0078297756E-08 ERRT= 4.8782267891E-08

LEGENDRE POLYNOMIALS

COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

C(1)= 1.4222326289E 00 ERRC= 3.0116234613E-01
C(2)= 8.1084488514E-02 ERRC= 1.0977915900E-01
C(3)= 4.7491677466E-03 ERRC= 7.7183819818E-03
C(4)= -2.1016091745E-04 ERRC= 1.9223490219E-04
C(5)= 2.4996301755E-06 ERRC= 1.8896577562E-06
C(6)= -8.8988314611E-09 ERRC= 6.1945737007E-09

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500000E 00	1.5000000E 00	1.5712578E 00	7.1257780E-02	1.0000000E 00
2	2.4200000E 00	1.7600000E 00	1.6514350E 00	-1.0856497E-01	1.0000000E 00
3	4.1000000E 00	1.6500000E 00	1.8399936E 00	1.8999364E-01	1.0000000E 00
4	5.7000000E 00	2.1700000E 00	2.0288193E 00	-1.4118066E-01	1.0000000E 00
5	7.6500000E 00	2.4300000E 00	2.2593498E 00	-1.7065022E-01	1.0000000E 00
6	1.1300000E 01	2.4800000E 00	2.6555168E 00	1.7551683E-01	1.0000000E 00
7	1.5700000E 01	3.0000000E 00	3.0160961E 00	1.6096087E-02	1.0000000E 00
8	2.1600000E 01	3.0500000E 00	3.2543229E 00	2.0432294E-01	1.0000000E 00
9	2.4000000E 01	3.5800000E 00	3.2795050E 00	-3.0049502E-01	1.0000000E 00
10	3.4200000E 01	3.1200000E 00	3.1932507E 00	7.3250722E-02	1.0000000E 00
11	5.0000000E 01	4.0700000E 00	4.0600306E 00	-9.9693814E-03	1.0000000E 00
12	7.6100000E 01	5.2100000E 00	5.2104222E 00	4.2223022E-04	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)= 1.0815?94902E 00 ERRB= 4.4236356877E-01
B(2)= 2.9804?98269E-01 ERRB= ?.3676858369E-01
B(3)= -3.0938?84868E-02 ERRB= 3.8676223623E-02
B(4)= ?.1368?72390E-03 ERRB= ?.6270135474E-03
B(5)= -7.4032?22030E-05 ERRB= 8.?855461275E-05
B(6)= 1.1581?24072E-06 ERRB= 1.1927157419E-06
B(7)= -6.4562?12745E-09 ERRB= 6.?646376059E-09

SIGMA = ?.1?27321623E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)= ?.8350?00000E 00 ERRT= 9.?560183364E-02
T(?)= 4.5855?61683E-02 ERRT= ?.8?32915504E-03
T(3)= -3.0071?77524E-04 ERRT= 1.?679049694E-04
T(4)= ?.?865?79499E-05 ERRT= 7.?265747546E-06
T(5)= -9.1429?49615E-07 ERRT= 5.4572440?76E-07
T(6)= -7.0078?97756E-08 ERRT= 4.8531715188E-08
T(7)= -6.4562?12744E-09 ERRT= 6.?646376059E-09

LEGENDRE POLYNOMIALS
COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

C(1)= 1.0712?18546E 00 ERRC= 4.5363718725E-01
C(?)= ?.9932558136E-01 ERRC= ?.3826838395E-01
C(3)= -?.0667?63781E-02 ERRC= ?.5830485297E-02
C(4)= 8.5524?60777E-04 ERRC= 1.0513301051E-03
C(5)= -1.6923?63090E-05 ERRC= 1.8940334120E-05
C(6)= 1.4706?62315E-07 ERRC= 1.5145596722E-07
C(7)= -4.4718?92808E-10 ERRC= 4.?391429305E-10

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500?00E 00	1.5000000E 00	1.4981346E 00	-1.8653676E-03	1.0000000E 00
2	?.4?00?00E 00	1.?600000E 00	1.6494454E 00	-1.1055462E-01	1.0000000E 00
3	4.1000?00E 00	1.6500000E 00	1.9110941E 00	?.6109408E-01	1.0000000E 00
4	5.?000?00E 00	?.1?00000E 00	?.0995088E 00	-7.0491?21E-02	1.0000000E 00
5	7.6500?00E 00	?.4?00000E 00	?.?831137E 00	-1.4688634E-01	1.0000000E 00
6	1.1?00?00E 01	?.4800000E 00	?.5749715E 00	9.4971498E-??	1.0000000E 00
7	1.5?00?00E 01	3.0000000E 00	?.9141?20E 00	-8.5877969E-??	1.0000000E 00
8	?.1600?00E 01	3.0500000E 00	3.?933172E 00	?.4?31?20E-01	1.0000000E 00
9	?.4000?00E 01	3.5800000E 00	3.3?9?406E 00	-?.0075943E-01	1.0000000E 00
10	3.4?00?00E 01	3.1?00000E 00	3.1383656E 00	1.8365590E-??	1.0000000E 00
11	5.0000?00E 01	4.0?00000E 00	4.0686535E 00	-1.?464930E-03	1.0000000E 00
12	7.6100?00E 01	5.?100000E 00	5.?100330E 00	3.?008?84E-05	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

```
B( 1)=  1.6696232370E 00        ERRB=  7.4814204745E-01
B( 2)= -1.8685647429E-01        ERRB=  5.5030921493E-01
B( 3)=  9.0731000467E-02        ERRB=  1.3044050674E-01
B( 4)= -1.0939356548E-02        ERRB=  1.3640160369E-02
B( 5)=  6.1494183094E-04        ERRB=  7.1000553714E-04
B( 6)= -1.7307426071E-05        ERRB=  1.8935940213E-05
B( 7)=  2.3228041428E-07        ERRB=  2.4441819831E-07
B( 8)= -1.1673665045E-09        ERRB=  1.1947065633E-09

SIGMA =    2.1223568229E-01
```

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

```
T( 1)=  2.8350000000E 00        ERRT=  9.2982128933E-02
T( 2)=  4.5855761683E-02        ERRT=  2.8361532010E-03
T( 3)= -3.0071277524E-04        ERRT=  1.2736809761E-04
T( 4)=  2.2865279499E-05        ERRT=  7.3599513444E-06
T( 5)= -9.1429049615E-07        ERRT=  5.4821047846E-07
T( 6)= -7.0078297756E-08        ERRT=  4.8752803924E-08
T( 7)= -6.4562412744E-09        ERRT=  6.2931764862E-09
T( 8)= -1.1673665045E-09        ERRT=  1.1947065633E-09
```

LEGENDRE POLYNOMIALS

COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

```
C( 1)=  1.6999002253E 00        ERRC=  7.8852852236E-01
C( 2)= -1.9342650608E-01        ERRC=  5.5821247138E-01
C( 3)=  6.0839439590E-02        ERRC=  8.7358977855E-02
C( 4)= -4.3834353040E-03        ERRC=  5.4644071474E-03
C( 5)=  1.4063053469E-04        ERRC=  1.6236284081E-04
C( 6)= -2.1980078498E-06        ERRC=  2.4048084135E-06
C( 7)=  1.6089310081E-08        ERRC=  1.6929399017E-08
C( 8)= -4.3538144687E-11        ERRC=  4.4557820543E-11
```

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500000E 00	1.5000000E 00	1.5635393E 00	6.3539281E-02	1.0000000E 00
2	2.4200000E 00	1.7600000E 00	1.6134579E 00	-1.4654211E-01	1.0000000E 00
3	4.1000000E 00	1.6500000E 00	1.8295644E 00	1.7956445E-01	1.0000000E 00
4	5.7000000E 00	2.1700000E 00	2.0792680E 00	-9.0732034E-02	1.0000000E 00
5	7.6500000E 00	2.4300000E 00	2.3499296E 00	-8.0070390E-02	1.0000000E 00
6	1.1300000E 01	2.4800000E 00	2.6531830E 00	1.7318303E-01	1.0000000E 00
7	1.5700000E 01	3.0000000E 00	2.8235041E 00	-1.7649591E-01	1.0000000E 00
8	2.1600000E 01	3.0500000E 00	3.2349004E 00	1.8490038E-01	1.0000000E 00
9	2.4000000E 01	3.5800000E 00	3.4685215E 00	-1.1147846E-01	1.0000000E 00
10	3.4200000E 01	3.1200000E 00	3.1242848E 00	4.2847535E-03	1.0000000E 00
11	5.0000000E 01	4.0700000E 00	4.0698449E 00	-1.5514775E-04	1.0000000E 00
12	7.6100000E 01	5.2100000E 00	5.2100013E 00	1.3079261E-06	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

B(1)=	1.1506749819E 00	ERRB=	1.3685094493E 00
B(2)=	3.2247261229E-01	ERRB=	1.2293185733E 00
B(3)=	-7.4966074753E-02	ERRB=	3.7591587369E-01
B(4)=	1.3805215045E-02	ERRB=	5.3961156151E-02
B(5)=	-1.3165822059E-03	ERRB=	4.1184941203E-03
B(6)=	6.5543232148E-05	ERRB=	1.7465185579E-04
B(7)=	-1.7073460061E-06	ERRB=	4.0680361057E-06
B(8)=	2.1753288049E-08	ERRB=	4.7984005729E-08
B(9)=	-1.0554895343E-10	ERRB=	2.2087430509E-10

STGMA = 2.3424239882E-01

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

T(1)=	2.8350000000E 00	ERRT=	1.0349974157E-01
T(2)=	4.5855761683E-02	ERRT=	3.1569603584E-03
T(3)=	-3.0071277524E-04	ERRT=	1.4177514632E-04
T(4)=	2.2865279499E-05	ERRT=	8.1924610510E-06
T(5)=	-9.1429049615E-07	ERRT=	6.1022047327E-07
T(6)=	-7.0078297756E-08	ERRT=	5.4267403218E-08
T(7)=	-6.4562412744E-09	ERRT=	7.0050195768E-09
T(8)=	-1.1673665045E-09	ERRT=	1.3298439799E-09
T(9)=	-1.0554895343E-10	ERRT=	2.2087430509E-10

LEGENDRE POLYNOMIALS

COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

C(1)=	1.1254227300E 00	ERRC=	1.4886404397E 00
C(2)=	3.3078383852E-01	ERRC=	1.2607281236E 00
C(3)=	-5.0730528923E-02	ERRC=	2.5291466506E-01
C(4)=	5.5512255721E-03	ERRC=	2.1661041346E-02
C(5)=	-3.0146527086E-04	ERRC=	9.4262798375E-04
C(6)=	8.3274124500E-06	ERRC=	2.2187813486E-05
C(7)=	-1.1827137876E-07	ERRC=	2.8179722815E-07
C(8)=	8.1133381999E-10	ERRC=	1.7896132673E-09
C(9)=	-2.0994074420E-12	ERRC=	4.3934593707E-12

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500000E 00	1.5000000E 00	1.5316837E 00	3.1683737E-02	1.0000000E 00
2	2.4200000E 00	1.7600000E 00	1.6476338E 00	-1.1236616E-01	1.0000000E 00
3	4.1000000E 00	1.6500000E 00	1.8603086E 00	2.1030860E-01	1.0000000E 00
4	5.7000000E 00	2.1700000E 00	2.0599136E 00	-1.1008645E-01	1.0000000E 00
5	7.6500000E 00	2.4300000E 00	2.3089688E 00	-1.2103124E-01	1.0000000E 00
6	1.1300000E 01	2.4800000E 00	2.6802026E 00	2.0020259E-01	1.0000000E 00
7	1.5700000E 01	3.0000000E 00	2.8447376E 00	-1.5526241E-01	1.0000000E 00
8	2.1600000E 01	3.0500000E 00	3.1699175E 00	1.1991752E-01	1.0000000E 00
9	2.4000000E 01	3.5800000E 00	3.5149356E 00	-6.5064363E-02	1.0000000E 00
10	3.4200000E 01	3.1200000E 00	3.1217403E 00	1.7402868E-03	1.0000000E 00
11	5.0000000E 01	4.0700000E 00	4.0699574E 00	-4.2605679E-05	1.0000000E 00
12	7.6100000E 01	5.2100000E 00	5.2099932E 00	-6.7952788E-06	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

```
B( 1)=  2.9560?58857E 00        ERRB=  2.2900571405E 00
B( 2)= -1.7209?29973E 00        ERRB=  2.4132602297E 00
B( 3)=  7.4111?60558E-01        ERRB=  9.1806038617E-01
B( 4)= -1.4313?47739E-01        ERRB=  1.6820546606E-01
B( 5)=  1.5187?40676E-02        ERRB=  1.7248738755E-02
B( 6)= -9.4137?88835E-04        ERRB=  1.0365513534E-03
B( 7)=  3.4486?75382E-05        ERRB=  3.6948194792E-05
B( 8)= -7.2456?08116E-07        ERRB=  7.5872648133E-07
B( 9)=  7.9510?49234E-09        ERRB=  8.1709530613E-09
B(10)= -3.4812?69842E-11        ERRB=  3.5319615444E-11

SIGMA =    2.3?37703240F-01
```

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

```
T( 1)=  2.8350?00000E 00        ERRT=  1.0399307854E-01
T( 2)=  4.5855?61683E-02        ERRT=  3.1721227224E-03
T( 3)= -3.0071?77524E-04        ERRT=  1.4245606915E-04
T( 4)=  2.2865?79499E-05        ERRT=  8.2318881008E-06
T( 5)= -9.1429?49615E-07        ERRT=  6.1315126235E-07
T( 6)= -7.0078?97756E-08        ERRT=  5.4528040676E-08
T( 7)= -6.4562?12744E-09        ERRT=  7.0386635395E-09
T( 8)= -1.1673?65045E-09        ERRT=  1.3362310029E-09
T( 9)= -1.0554?95343E-10        ERRT=  2.2193512823E-10
T(10)= -3.4812?69841E-11        ERRT=  3.5319615443E-11
```

LEGENDRE POLYNOMIALS

COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

```
C( 1)=  3.2067?72700E 00        ERRC=  2.5877134906E 00
C( 2)= -1.8072?79721E 00        ERRC=  2.5119599939E 00
C( 3)=  5.0277?98579E-01        ERRC=  6.1639203267E-01
C( 4)= -5.7672?87645E-02        ERRC=  6.7737137316E-02
C( 5)=  3.4822?10910E-03        ERRC=  3.9539863956E-03
C( 6)= -1.1968?43307E-04        ERRC=  1.3178032494E-04
C( 7)=  2.3897?24100E-06        ERRC=  2.5602358377E-06
C( 8)= -2.7026?30366E-08        ERRC=  2.8300286981E-08
C( 9)=  1.5815?58511E-10        ERRC=  1.6264958730E-10
C(10)= -3.6659?79018E-13        ERRC=  3.7193836089E-13
```

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500?00E 00	1.5000000E 00	1.5935264E 00	9.3526429E-02	1.0000000E 00
2	2.4200?00E 00	1.7600000E 00	1.5530148E 00	-2.0698524E-01	1.0000000E 00
3	4.1000?00E 00	1.6500000E 00	1.8453652E 00	1.9536521E-01	1.0000000E 00
4	5.7000?00E 00	2.1700000E 00	2.1364727E 00	-3.3527312E-02	1.0000000E 00
5	7.6500?00E 00	2.4300000E 00	2.3261129E 00	-1.0388706E-01	1.0000000E 00
6	1.1300?00E 01	2.4800000E 00	2.5692258E 00	8.9225792E-02	1.0000000E 00
7	1.5700?00E 01	3.0000000E 00	2.9527447E 00	-4.7255311E-02	1.0000000E 00
8	2.1600?00E 01	3.0500000E 00	3.0758690E 00	2.5869048E-02	1.0000000E 00
9	2.4000?00E 01	3.5800000E 00	3.5674400E 00	-1.2560009E-02	1.0000000E 00
10	3.4200?00E 01	3.1200000E 00	3.1202337E 00	2.3374049E-04	1.0000000E 00
11	5.0000?00E 01	4.0700000E 00	4.0700046E 00	4.6195928E-06	1.0000000E 00
12	7.6100?00E 01	5.2100000E 00	5.2103695E 00	3.6949408E-04	1.0000000E 00

COEFFICIENTS OF Y=B1+B2*X+ETC AND ERRORS

```
B( 1)= -2.1070681001E 00      ERRB=  3.2990040286E 00
B( 2)=  4.9937699080E 00      ERRB=  4.1795509236E 00
B( 3)= -2.5740944661E 00      ERRB=  1.9920639268E 00
B( 4)=  6.7464124777E-01      ERRB=  4.8024011815E-01
B( 5)= -9.8712078887E-02      ERRB=  6.5960495510E-02
B( 6)=  8.5878696914E-03      ERRB=  5.4735147946E-03
B( 7)= -4.5729630475E-04      ERRB=  2.8117445611E-04
B( 8)=  1.4885189213E-05      ERRB=  8.9028084017E-06
B( 9)= -2.8544509372E-07      ERRB=  1.6713435209E-07
B(10)=  2.9231563293E-09      ERRB=  1.6842122865E-09
B(11)= -1.2162041537E-11      ERRB=  6.9246056339E-12

SIGMA =    1.6619607141E-01
```

COEFFICIENTS OF Y=T1*P1+T2*P2+ETC AND ERRORS

```
T( 1)=  2.8350000000E 00      ERRT=  7.2845204340E-02
T( 2)=  4.5855761683E-02      ERRT=  2.2209155163E-03
T( 3)= -3.0071277524E-04      ERRT=  9.9738541683E-05
T( 4)=  2.2865279499E-05      ERRT=  5.7633805305E-06
T( 5)= -9.1429049615E-07      ERRT=  4.2928892467E-07
T( 6)= -7.0078997756E-08      ERRT=  3.8177013379E-08
T( 7)= -6.4562612744E-09      ERRT=  4.9280177462E-09
T( 8)= -1.1673465045E-09      ERRT=  9.3554267203E-10
T( 9)= -1.0554995343E-10      ERRT=  1.5538464714E-10
T(10)= -3.4812469841E-11      ERRT=  2.4728514258E-11
T(11)= -1.2162041537E-11      ERRT=  6.9246056339E-12
```

LEGENDRE POLYNOMIALS

COEFFICIENTS OF Y=C1*L1+C2*L2+ETC AND ERRORS

```
C( 1)= -2.9849073645E 00      ERRC=  3.9633493287E 00
C( 2)=  5.4022301347E 00      ERRC=  4.4654057025E 00
C( 3)= -1.7726877551E 00      ERRC=  1.3654568734E 00
C( 4)=  2.7367064615E-01      ERRC=  1.9451559301E-01
C( 5)= -2.2705390620E-02      ERRC=  1.5163997558E-02
C( 6)=  1.0935772271E-03      ERRC=  6.9687115621E-04
C( 7)= -3.1711111041E-05      ERRC=  1.9496861098E-05
C( 8)=  5.5538044247E-07      ERRC=  3.3217235804E-07
C( 9)= -5.6784241317E-09      ERRC=  3.3248321811E-09
C(10)=  3.0782723994E-11      ERRC=  1.7735843082E-11
C(11)= -6.7412436584E-14      ERRC=  3.8379247056E-14
```

I	X(I)	F(I)	Y(I)	DELY(I)	W(I)
1	1.6500000E 00	1.5000000E 00	1.5198622E 00	1.9862177E-02	1.0000000E 00
2	2.4200000E 00	1.7600000E 00	1.7065260E 00	-5.3473991E-02	1.0000000E 00
3	4.1000000E 00	1.6500000E 00	1.7455127E 00	9.5512671E-02	1.0000000E 00
4	5.7000000E 00	2.1700000E 00	2.0622405E 00	-1.0775955E-01	1.0000000E 00
5	7.6500000E 00	2.4300000E 00	2.4878193E 00	5.7819322E-02	1.0000000E 00
6	1.1300000E 01	2.4800000E 00	2.4644101E 00	-1.5589896E-02	1.0000000E 00
7	1.5700000E 01	3.0000000E 00	3.0045355E 00	4.5354827E-03	1.0000000E 00
8	2.1600000E 01	3.0500000E 00	3.0484432E 00	-1.5568439E-03	1.0000000E 00
9	2.4000000E 01	3.5800000E 00	3.5806538E 00	6.5376511E-04	1.0000000E 00
10	3.4200000E 01	3.1200000E 00	3.1199946E 00	-5.3513795E-06	1.0000000E 00
11	5.0000000E 01	4.0700000E 00	4.0698099E 00	-1.9014115E-04	1.0000000E 00
12	7.6100000E 01	5.2100000E 00	5.2052258E 00	-4.7741801E-03	1.0000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K= 2


```
-2.120167E 01   1.000000E 00
```

ORTHOGONAL POLYNOMIAL COEFF FOR K= 3

```
 6.079560E 02  -7.188689E 01   1.000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K=    4

-1.318828E 04   2.914591E 03  -1.108713E 02   1.000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K=    5

 2.673466E 05  -9.098033E 04   6.393286E 03  -1.449485E 02   1.000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K=    6

-4.079492E 06   1.939241E 06  -2.253981E 05   9.713631E 03  -1.690990E 02   1.000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K=    7

 5.240331E 07  -3.355553E 07   5.893947E 06  -4.123380E 05   1.316057E 04  -1.902309E 02   1.000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K=    8

-5.037782E 08   4.153781E 08  -1.042264E 08   1.120145E 07  -5.901952E 05   1.581811E 04  -2.045165E 02   1.000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K=    9

 4.916659E 09  -4.825515E 09   1.569868E 09  -2.344369E 08   1.829979E 07  -7.849501E 05   1.837664E 04  -2.171623E 02
 1.000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K=   10

-5.187655E 10   5.869752E 10  -2.344225E 10   4.508175E 09  -4.740980E 08   2.892409E 07  -1.039688E 06   2.143832E 04
-2.314278E 02   1.000000E 00

ORTHOGONAL POLYNOMIAL COEFF FOR K=   11

 4.163215E 11  -5.520616E 11   2.725666E 11  -6.723511E 10   9.364513E 09  -7.834655E 08   4.043291E 07  -1.283387E 06
 2.412214E 04  -2.431952E 02   1.000000E 00
```

MAX. DEGREE OF POLYNOMIAL LIMITED TO 10 BY USE OF LEGENDRE POLYNOMIAL FIT

>>>> END OF LEAST SQUARES FIT <<<<